

DMCI0099.ST25.txt
SEQUENCE LISTING

<110> Havkin-Frenkel, Daphna
Podstolski, Andrzej
Dixon, Richard A.

<120> Vanillin Biosynthetic Pathway Enzyme From Vanilla Planifolia

<130> DMCI0099

<150> 09/462,576
<151> 2000-05-22

<150> PCT/US98/14895
<151> 1998-07-15

<150> 60/052,604
<151> 1997-07-15

<150> 60/272,415
<151> 2001-02-28

<160> 25

<170> PatentIn version 3.1

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cctgccatcc tcggcgtcct tggcagttgc cgccacgcct tccacttcgc acggttcgcc 180
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Thr Gln Arg Pro Asp Ser Ile Glu Pro Ala Ile Leu Gly Val Leu Gly
35 40 45

Ser Cys Arg His Ala Phe His Phe Ala Arg Phe Ala Arg Arg Tyr Gly
50 55 60

Lys Ser Tyr Gly Ser Glu Glu Ile Lys Lys Arg Phe Gly Ile Phe
65 70 75 80

Val Glu Asn Leu Ala Phe Ile Arg Ser Thr Asn Arg Lys Asp Leu Ser
85 90 95

Tyr Thr Leu Gly Ile Asn Gln Phe Ala Asp Leu Thr Trp Glu Glu Phe
100 105 110

Arg Thr Asn Arg Leu Gly Ala Ala Gln Asn Cys Ser Ala Thr Ala His
115 120 125

Gly Asn His Arg Phe Val Asp Gly Val Leu Pro Val Thr Arg Asp Trp
130 135 140

Arg Glu Gln Gly Ile Val Ser Pro Val Lys Asp Gln Gly Ser Cys Gly
145 150 155 160

Ser Trp Thr Phe Ser Thr Thr Gly Ala Leu Glu Ala Ala Tyr Thr Gln
165 170 175

Leu Thr Gly Ser Thr Leu Ser Glu Gln Gln Leu Val Asp Cys Ala Ser
180 185 190

Ala Phe Asn Asn Phe Gly Cys Gly Gly Leu Pro Ser Gln Ala Phe Glu
195 200 205

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Tyr Val Lys Tyr Asn Gly Gly Ile Asp Thr Glu Gln Thr Tyr Pro Tyr
210 215 220

Leu Gly Val Met Gly Ile Cys Asn Phe Lys Gln Glu Asn Val Gly Val
225 230 235 240

Lys Val Ile Asp Ser Ile Asn Ile Thr Leu Gly Ala Glu Asp Glu Leu
245 250 255

Lys His Ala Val Gly Leu Val Arg Pro Val Ser Val Ala Phe Glu Val
260 265 270

Val Lys Gly Phe Asn Leu Tyr Lys Lys Gly Val Tyr Ser Ser Asp Thr
275 280 285

Cys Gly Arg Asp Pro Met Asp Val Asn His Ala Val Leu Ala Val Gly
290 295 300

Tyr Gly Val Glu Asp Gly Ile Pro Tyr Trp Leu Ile Lys Asn Ser Trp
305 310 315 320

Gly Thr Asn Trp Gly Asp Asn Gly Tyr Phe Lys Met Glu Leu Gly Lys
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<223> 4HBS P2a

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Arg Met Val Ser Asp Gly Leu Arg Glu Val Glu Glu Ser Val Ser Gln
 35 40 45

Ile Leu Gly Gln Ser Arg His Val Leu Ser Phe Ala Arg Phe Thr His
 50 55 60

Arg Tyr Gly Lys Lys Tyr Gln Asn Val Glu Glu Met Lys Leu Arg Phe
 65 70 75 80

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Ser Ile Phe Lys Glu Asn Leu Asp Leu Ile Arg Ser Thr Asn Lys Lys
85 90 95

Gly Leu Ser Tyr Lys Leu Gly Val Asn Gln Phe Ala Asp Leu Thr Trp
100 105 110

Gln Glu Phe Gln Arg Thr Lys Leu Gly Ala Ala Gln Asn Cys Ser Ala
115 120 125

Thr Leu Lys Gly Ser His Lys Val Thr Glu Ala Ala Leu Pro Glu Thr
130 135 140

Lys Asp Trp Arg Glu Asp Gly Ile Val Ser Pro Val Lys Asp Gln Gly
145 150 155 160

Gly Cys Gly Ser Cys Trp Thr Phe Ser Thr Thr Gly Ala Leu Glu Ala
165 170 175

Ala Tyr His Gln Ala Phe Ala Phe Gly Lys Gly Ile Ser Leu Ser Glu
180 185 190

Gln Gln Leu Val Asp Cys Ala Gly Ala Phe Asn Asn Tyr Gly Cys Asn
195 200 205

Gly Gly Leu Pro Ser Gln Ala Phe Glu Tyr Ile Lys Ser Asn Gly Gly
210 215 220

Leu Asp Thr Glu Lys Ala Tyr Pro Tyr Thr Gly Lys Asp Glu Thr Cys
225 230 235 240

Lys Phe Ser Ala Glu Asn Val Gly Val Gln Val Leu Asn Ser Val Ser
245 250 255

Ile Thr Leu Gly Ala Glu Asp Glu Leu Lys His Ala Val Gly Leu Val
260 265 270

Arg Pro Val Ser Ile Ala Phe Glu Val Ile His Ser Phe Arg Leu Tyr
275 280 285

Lys Ser Gly Val Tyr Thr Asp Ser His Cys Gly Ser Thr Pro Met Asp
290 295 300

Val Asn His Ala Val Leu Ala Val Gly Tyr Gly Val Glu Asp Gly Val
305 310 315 320

Pro Tyr Trp Leu Ile Lys Asn Ser Trp Gly Ala Asp Trp Gly Asp Lys
325 330 335

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Cys Ala Ser Tyr Pro Val Val Ala
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35 40 45

Leu Gly Ala Leu Gly Arg Thr Arg His Ala Leu Arg Phe Ala Arg Phe
50 55 60

Ala Val Arg Tyr Gly Lys Ser Tyr Glu Ser Ala Ala Glu Val Arg Arg
65 70 75 80

Arg Phe Arg Ile Phe Ser Glu Ser Leu Glu Glu Val Arg Ser Thr Asn
85 90 95

Arg Lys Gly Leu Pro Tyr Arg Leu Gly Ile Asn Arg Phe Ser Asp Met
100 105 110

Ser Trp Glu Glu Phe Gln Ala Thr Arg Leu Gly Ala Ala Gln Thr Cys
115 120 125

Ser Ala Thr Lys Gly Asn His Leu Met Arg Asp Ala Ala Ala Leu Pro
130 135 140

Glu Thr Lys Asp Trp Arg Glu Asp Gly Ile Val Ser Pro Val Lys Asn
145 150 155 160

Gln Ala His Cys Gly Ser Cys Trp Thr Phe Ser Thr Thr Gly Ala Leu
165 170 175

Glu Ala Ala Tyr Thr Gln Ala Thr Gly Lys Asn Ile Ser Leu Ser Glu
180 185 190

Gln Gln Leu Val Asp Cys Ala Gly Gly Phe Asn Asn Phe Gly Cys Asn

195

200

205

Gly Gly Leu Pro Ser Gln Ala Phe Glu Tyr Ile Lys Tyr Asn Gly Gly
 210 215 220

Ile Asp Thr Glu Glu Ser Tyr Pro Tyr Lys Gly Val Asn Gly Val Cys
 225 230 235 240

His Tyr Lys Ala Glu Asn Ala Ala Val Gln Val Leu Asp Ser Val Asn
 245 250 255

Ile Thr Leu Asn Ala Glu Asp Glu Leu Lys Asn Ala Val Gly Leu Val
 260 265 270

Arg Pro Val Ser Val Ala Ala Phe Gln Val Ile Asp Gly Phe Arg Gln
 275 280 285

Tyr Lys Ser Gly Val Tyr Thr Ser Asp His Cys Gly Thr Thr Pro Asp
 290 295 300

Asp Val Asn His Ala Val Leu Ala Val Gly Tyr Gly Val Glu Asn Gly
 305 310 315 320

Val Pro Tyr Trp Leu Ile Lys Asn Ser Trp Gly Ala Asp Trp Gly Asp
 325 330 335

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 35 40 45

Leu Gln Val Val Gly Lys Thr Arg His Ala Leu Ser Phe Ala Arg Phe
 50 55 60

Ala His Arg Tyr Gly Lys Arg Tyr Glu Ser Val Glu Glu Ile Lys Gln
65 70 75 80

Arg Phe Glu Val Phe Leu Asp Asn Leu Lys Met Ile Arg Ser His Asn
85 90 95

Lys Lys Gly Leu Ser Tyr Lys Leu Gly Val Asn Glu Phe Thr Asp Leu
100 105 110

Thr Trp Asp Glu Phe Arg Arg Asp Arg Leu Gly Ala Ala Gln Asn Cys
115 120 125

Ser Ala Thr Thr Lys Gly Asn Leu Lys Val Thr Asn Val Val Leu Pro
130 135 140

Glu Thr Lys Asp Trp Arg Glu Ala Gly Ile Val Ser Pro Val Lys Asn
145 150 155 160

Gln Gly Lys Cys Gly Ser Cys Trp Thr Phe Ser Thr Thr Gly Ala Leu
165 170 175

Glu Ala Ala Tyr Ser Gln Ala Phe Gly Lys Gly Ile Ser Leu Ser Glu
180 185 190

Gln Gln Leu Val Asp Cys Ala Gly Ala Phe Asn Asn Phe Gly Cys Asn
195 200 205

Gly Gly Leu Pro Ser Gln Ala Phe Glu Tyr Ile Lys Ser Asn Gly Gly
210 215 220

Leu Asp Thr Glu Glu Ala Tyr Pro Tyr Thr Gly Lys Asn Gly Leu Cys
225 230 235 240

Lys Phe Ser Ser Glu Asn Val Gly Val Lys Val Ile Asp Ser Val Asn
245 250 255

Ile Thr Leu Gly Ala Glu Asp Glu Leu Lys Tyr Ala Val Ala Leu Val
260 265 270

Arg Pro Val Ser Ile Ala Phe Glu Val Ile Lys Gly Phe Lys Gln Tyr
275 280 285

Lys Ser Gly Val Tyr Thr Ser Thr Glu Cys Gly Asn Thr Pro Met Asp
290 295 300

Val Asn His Ala Val Leu Ala Val Gly Tyr Gly Val Glu Asp Gly Val
305 310 315 320

Pro Tyr Trp Leu Ile Lys Asn Ser Trp Gly Ala Asp Trp Gly Asp Glu
 325 330 335

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 340 345 350

Cys Ala Ser Tyr Pro Val Val Ala
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 20 25 30

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 35 40 45

Ala Leu Gly Arg Thr Arg Asp Ala Leu Arg Phe Ala Arg Phe Ala Val
 50 55 60

Arg Tyr Gly Lys Ser Tyr Glu Ser Ala Ala Glu Val His Lys Arg Phe
 65 70 75 80

Arg Ile Phe Ser Glu Ser Leu Gln Leu Val Arg Ser Thr Asn Arg Lys
 85 90 95

Gly Leu Ser Tyr Arg Leu Gly Ile Asn Arg Phe Ala Asp Met Ser Trp
 100 105 110

Glu Glu Phe Arg Ala Thr Arg Leu Gly Ala Ala Gln Asn Cys Ser Ala
 115 120 125

Thr Leu Thr Gly Asn His Arg Met Arg Ala Ala Ala Val Ala Leu Pro
 130 135 140

Glu Thr Lys Asp Trp Arg Glu Asp Gly Ile Val Ser Pro Val Lys Asn
 145 150 155 160

Gln Gly His Cys Gly Ser Cys Trp Thr Phe Ser Thr Thr Gly Ala Leu
 165 170 175

Glu Ala Ala Tyr Thr Gln Ala Thr Gly Lys Pro Ile Ser Leu Ser Glu
180 185 190

Gln Gln Leu Val Asp Cys Gly Leu Ala Phe Asn Asn Phe Gly Cys Asn
195 200 205

Gly Gly Leu Pro Ser Gln Ala Phe Glu Tyr Ile Lys Tyr Asn Gly Gly
210 215 220

Leu Asp Thr Glu Glu Ser Tyr Pro Tyr Gln Gly Val Asn Gly Ile Ser
225 230 235 240

Lys Phe Lys Asn Glu Asn Val Gly Val Lys Val Leu Asp Ser Val Asn
245 250 255

Ile Thr Leu Gly Ala Glu Asp Glu Leu Lys Asp Ala Val Gly Leu Val
260 265 270

Arg Pro Val Ser Val Ala Phe Glu Val Ile Thr Gly Phe Arg Leu Tyr
275 280 285

Lys Ser Gly Val Val Thr Ser Asp His Cys Gly Thr Thr Pro Met Asp
290 295 300

Val Asn His Ala Val Leu Ala Val Gly Tyr Gly Val Glu Asp Gly Val
305 310 315 320

Pro Tyr Trp Leu Ile Lys Asn Ser Trp Gly Ala Asp Trp Gly Asp Glu
325 330 335

Gly Tyr Phe Lys Met Glu Met Gly Lys Asn Met Cys Gly Val Ala Thr
340 345 350

Cys Ala Ser Tyr Pro Ile Val Ala
355 360

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<213> Zea mays

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20 25 30

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Pro Ile Arg Pro Val Thr Asp Arg Ala Ala Ser Ala Leu Glu Ser Thr
35 40 45

Val Phe Ala Ala Leu Gly Arg Thr Arg Asp Ala Leu Arg Phe Ala Arg
50 55 60

Phe Ala Val Arg Tyr Gly Lys Ser Tyr Glu Ser Ala Ala Glu Val His
65 70 75 80

Lys Arg Phe Arg Ile Phe Ser Glu Ser Leu Gln Leu Val Arg Ser Thr
85 90 95

Asn Arg Lys Gly Leu Ser Tyr Arg Leu Gly Tyr Asn Arg Phe Ala Asp
100 105 110

Met Ser Trp Glu Glu Phe Arg Ala Thr Arg Leu Gly Ala Ala Gln Asn
115 120 125

Cys Ser Ala Thr Leu Thr Gly Asn His Arg Met Arg Ala Ala Ala Val
130 135 140

Ala Leu Pro Glu Thr Lys Asp Trp Arg Glu Asp Gly Ile Val Ser Pro
145 150 155 160

Val Lys Asn Gln Gly His Cys Gly Ser Cys Trp Thr Phe Ser Thr Thr
165 170 175

Gly Ala Leu Glu Ala Ala Tyr Thr Gln Ala Thr Gly Lys Pro Ile Ser
180 185 190

Leu Ser Glu Gln Gln Leu Val Asp Cys Gly Phe Ala Phe Asn Asn Phe
195 200 205

Gly Cys Asn Gly Gly Leu Pro Ser Gln Ala Phe Glu Tyr Ile Lys Tyr
210 215 220

Asn Gly Gly Leu Asp Thr Glu Glu Ser Tyr Pro Tyr Gln Gly Val Asn
225 230 235 240

Gly Ile Cys Lys Phe Lys Asn Glu Asn Val Gly Val Lys Val Leu Asp
245 250 255

Ser Val Asn Ile Thr Leu Gly Ala Glu Asp Glu Leu Lys Asp Ala Val
260 265 270

Gly Leu Val Arg Pro Val Ser Val Ala Phe Glu Val Ile Thr Gly Phe
275 280 285

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Arg Leu Tyr Lys Ser Gly Val Tyr Thr Ser Asp His Cys Gly Thr Thr
290 295 300

Pro Met Asp Val Asn His Ala Val Leu Ala Val Gly Tyr Gly Val Glu
305 310 315 320

Asp Gly Val Pro Tyr Trp Leu Ile Lys Asn Ser Trp Gly Ala Asp Trp
325 330 335

Gly Asp Glu Gly Tyr Phe Lys Met Glu Met Gly Lys Asn Met Cys Gly
340 345 350

Val Ala Thr Cys Ala Ser Tyr Pro Ile Val Ala
355 360

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<213> Oryza sativa

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20 25 30

Pro Ile Arg Ser Val Thr Asp His Ala Ala Ser Ala Leu Glu Ser Thr
35 40 45

Val Ile Ala Ala Leu Gly Arg Thr Arg Gly Ala Leu Arg Phe Ala Arg
50 55 60

Phe Ala Val Arg Gly His Lys Arg Tyr Gly Asp Ala Ala Glu Val Gln
65 70 75 80

Arg Arg Phe Arg Ile Phe Ser Glu Ser Leu Glu Leu Val Arg Ser Thr
85 90 95

Asn Arg Arg Gly Leu Pro Tyr Arg Leu Gly Ile Asn Arg Phe Ala Asp
100 105 110

Met Ser Trp Glu Glu Phe Gln Ala Ser Arg Leu Gly Ala Ala Gln Asn
115 120 125

Cys Ser Ala Thr Leu Ala Gly Asn His Arg Met Arg Asp Ala Pro Ala
130 135 140

Leu Pro Glu Thr Lys Asp Trp Arg Glu Asp Gly Ile Val Ser Pro Val
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145 150 155 160
 Lys Asp Gln Gly His Cys Gly Ser Cys Trp Pro Phe Ser Thr Thr Gly
 165 170 175
 Ser Leu Glu Ala Arg Tyr Thr Gln Ala Thr Gly Pro Pro Val Ser Leu
 180 185 190
 Ser Glu Gln Gln Leu Ala Asp Cys Ala Thr Arg Tyr Asn Asn Phe Gly
 195 200 205
 Cys Ser Gly Gly Leu Pro Ser Gln Ala Phe Glu Tyr Ile Lys Tyr Asn
 210 215 220
 Gly Gly Leu Asp Thr Glu Glu Ala Tyr Pro Tyr Thr Gly Val Asn Gly
 225 230 235 240
 Ile Cys His Tyr Lys Pro Glu Asn Ala Gly His Lys Val Leu Asp Ser
 245 250 255
 Val Asn Ile Thr Leu Val Ala Glu Asp Glu Leu Lys Asn Ala Val Gly
 260 265 270
 Leu Val Arg Pro Val Ser Val Ala Phe Gln Val Ile Asn Gly Phe Arg
 275 280 285
 Met Tyr Lys Ser Gly Val Tyr Thr Ser Asp His Cys Gly Thr Ser Pro
 290 295 300
 Met Asp Val Asn His Ala Val Leu Ala Val Gly Tyr Gly Val Glu Asn
 305 310 315 320
 Gly Val Pro Tyr Trp Leu Ile Lys Asn Ser Trp Gly Ala Asp Trp Gly
 325 330 335
 Asp Asn Gly Tyr Phe Thr Met Glu Met Gly Lys Asn Met Cys Gly Ile
 340 345 350
 Ala Thr Cys Ala Ser Tyr Pro Ile Val Ala
 355 360